

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANTS: J. G. Bednorz et al

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EXAMINER:

FOR: NEW SUPERCONDUCTIVE COMPOUNDS HAVING HIGH TRANSITION TEMPERATURE
AND METHODS FOR THEIR USE AND PREPARATION

DECLARATION OF PRAVEEN CHAUDHARI RELATIVE TO HIGH T_C
SUPERCONDUCTIVITY

TO: The Commissioner of Patents and Trademarks
Washington, D.C. 20231

I, Praveen Chaudhari, hereby declare and say that:

1. During 1986 I was Vice President, Science, for the Research Division of International Business Machines Corporation, the assignee of the subject patent application. In my capacity as vice president, I had operational responsibility for all of the activities relating to science in the Research Division's main laboratory at Yorktown Heights, New York, and additionally had responsibility and control concerning the strategy, growth, and

resources in the general area of science in the IBM Research laboratories located in Zurich, Switzerland and Almaden, California. It was my general responsibility to determine the research projects to be conducted at these various laboratories and to routinely check with the personnel at these laboratories to determine that the strategy was being followed. Additionally, through my own communications and examination of regular progress reports concerning activities in science in the three research laboratories, each laboratory was aware of the activities in science at each other laboratory, and in many instances collaboration between scientists at 2 or 3 of the laboratories could and did occur. In many instances, the science activities at the different laboratories complement the activities at the other laboratories in order to provide a cohesive and directed research effort.

2. The work of Alex Mueller and J. Georg Bednorz at IBM's Zurich Research laboratory which lead to their discovery of high temperature superconductivity as revealed in their paper in Z. Phys. B-Condensed Matter 64, 189-193 (1986) was known to me, dating back to 1982. I spoke with Alex Mueller at that time about techniques which may be

used to increase the electron concentration in oxide materials in order to obtain higher critical transition temperatures in such materials. One technique which we discussed for accomplishing this was the application of an electric field to essentially create an inversion layer having an increased electron density. At that time, he and I believed that the provision of higher critical transition temperatures in these materials would require higher electron density and the application of an electric field was one of the techniques we discussed for achieving this. In the time period between our 1982 conversation and 1986, I followed the work of Alex Mueller and J. Georg Bednorz and, having responsibility in my role as vice president, science, I was aware of their work through the issuance of monthly progress (activity) reports from the Zurich Research laboratory. I also visited the Zurich laboratory on a regular basis to confer with scientific personnel at the laboratory in order to review their programs and the progress in these programs.

3. In July, 1986, I visited the Zurich laboratory of Alex Mueller and J. Georg Bednorz and talked with Alex Mueller concerning his experiments on what are now known as high

T_c oxide superconductors. More specifically, I was shown the data of Mueller and Bednorz relative to the superconducting La-Ba-Cu-O oxide superconductors that they had discovered and measured.

4. While I was visiting with Mueller and Bednorz in July, 1986, they gave me a copy of the aforementioned technical paper that they had submitted to Z. Phys. B. At that time, Alex Mueller asked me to withhold dissemination of the paper until the end of August or beginning of September 1986. This I did.
5. I returned to the United States from the Zurich laboratory shortly thereafter, and held my copy of the submitted Mueller and Bednorz paper until the date indicated by them for dissemination to other scientists at IBM's research laboratory in Yorktown Heights New York. At that time, I gave a copy of this paper to Alex Malozemoff, a senior manager in the Physical Sciences Department at the Yorktown Laboratory. Alex Malozemoff, who reported to me, said that he gave a copy of the paper to Chang Tsuei and Richard L. Greene, both of whom reported to Alex Malozemoff and are scientists at the Yorktown Research Laboratory.

6. In Mid October, 1986, I made a return trip to the IBM Zurich Research Laboratory and again met with Alex Mueller, who told me that magnetic measurements had been completed on the superconducting materials that he described and showed me in July 1986. Alex Mueller told me that his magnetic measurements convinced him of the superconductivity present in these materials. Our meeting occurred in the time frame October 15-17, 1986. While in Zurich, I discussed possible experiments that Mueller and Bednorz would do concerning these newly discovered superconductors and suggested an experiment in which persistent currents could be established in these new materials, the persistent currents then being measured using a SQUID device. Later, I received a computer message from Mueller and Bednorz relative to this experiment, indicating that it seemed to work as we had proposed.

7. Bednorz and Mueller told me that the magnetic measurements they made indicated to them the diamagnetic response of these superconducting materials. These measurements made even more convincing to them and to me their earlier contention that they had discovered a new class of superconducting materials having critical tran-

sition temperatures higher than any of those previously reported.

8. While I was at the Zurich Research Laboratory in October 1986, Alex Mueller gave me samples of the superconducting material discovered by himself and J. Georg Bednorz to bring to the United States for evaluation in the United States. These materials were samples of La-Ba-Cu-O oxides as described in the aforementioned Bednorz and Mueller technical paper appearing in Z. Phys. B. I returned to the United States on approximately October 17, 1986, bringing with me samples of Bednorz and Mueller's superconducting materials, and their resistivity and diamagnetic measurement data which proved high temperature superconductivity.

9. Prior to October 17, 1986, and in the general time period between about September 1, 1986 to October 17, 1986, I was aware (based on conversations with them) that Richard Greene and Chang Tsuei were in contact with Alex Mueller and J. Georg Bednorz in order to discuss work that could be done in the United States by Greene and Tsuei, using the Mueller and Bednorz samples. These samples had been requested from Mueller and Bednorz by Richard Greene and

Chang Tsuei, and I carried the samples from Zurich to the United States at their request.

10. Upon my return to the United States, I gave these samples to Richard Greene, who proceeded to do specific heat and resistivity measurements on these samples, under the general guidance of Mueller and Bednorz in Zurich, Switzerland. I met Chang Tsuei within approximately two weeks after I had given Greene the samples in order to ask him how the data and measurements were progressing. Chang Tsuei replied that he had done resistivity versus temperature measurements on the samples, and that the resistivity data was good, indicating a drop to zero resistivity at an onset temperature above 30°K. The specific heat data of Richard Greene was a bit inconclusive as I recall, but the resistivity data was excellent in indicating a resistivity drop substantially identical to that reported in the Mueller and Bednorz publication appearing in Z. Phys. B.

11. In October, 1986, I also asked Alex Mueller about his work with Bednorz dealing with the replacement of Ba by Ca and Sr. Alex Mueller informed me that experiments were in progress using these elements and that Sr substitution

gave promising results and that Ca substitution was also being done. These compositions were La-Sr-Cu-O oxides and La-Ca-Cu-O oxides.

12. In November and December 1986, I had further discussions with Alex Malozemoff, Richard Greene and Chang Tsuei regarding their work on these high T_c superconducting samples. I also contacted the Zurich Research laboratory in order to propose a press release on the Zurich discovery, which was recognized to be a significant achievement in science.

13. I know of no other facts which would present a factual situation different than that described hereinabove, and assert that the facts described hereinabove are based on my own experience and recollection concerning the events occurring relative to the discovery of high T_c superconductivity and the activities in the United States which were directed by me to re-establish the results first accomplished by Mueller and Bednorz in Zurich, Switzerland. With the exception of the acts conducted in Zurich by Mueller and Bednorz and my acts while visiting IBM's Zurich Laboratory, all acts described hereinabove occurred in the United States.

14. I, further declare that all statements made hereinabove are of my own knowledge and are true and that all statements made on information and belief are believed by me to be true. Further, I declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of a Patent Application or any patent issuing thereon.

Praveen Chaudhari April 21, 1988

PRAVEEN CHAUDHARI

DATE